ISSN (print) 0093-4666 © 2015. Mycotaxon, Ltd. ISSN (online) 2154-8889

MYCOTAXON

http://dx.doi.org/10.5248/130.429

Volume 130, pp. 429–436 *April–June 2015*

Graphis hongkongensis sp. nov. and other *Graphis* spp. new to Hong Kong

Wei Guo [1,2] & Jae-Seoun Hur[1]*

[1]*Korean Lichen Research Institute, Sunchon National University, Suncheon 540-950, Korea*
[2]*State Key Laboratory of Mycology, Institute of Microbiology, Chinese Academy of Sciences, Beijing 100101, China*

* Correspondence to: *jshur1@sunchon.ac.kr*

Abstract — Eleven *Graphis* species are newly recorded from Hong Kong. *Graphis hongkongensis* is new to science, *G. centrifuga* and *G. hyphosa* are new to China, and *G. assimilis, G. descissa*, *G. duplicata, G. immersella, G. immersicans, G. japonica, G. parallela,* and *G. plagiocarpa* are new to Hong Kong. *Graphis hongkongensis* possesses *lineola*-morph lirellae, a completely carbonized exciple, small to medium-sized ascospores, and the presence of stictic acid. A brief description of each species is given.

Key words — *Graphidaceae*, lichenized fungi, new species

Introduction

Graphidaceae, with over 2300 species belonging to more than 50 genera, is considered the largest crustose lichen community (Lücking et al. 2009; Rivas Plata et al. 2010, 2012; Rivas Plata & Lücking 2013). *Graphis,* its type genus, is characterized by lirelliform ascomata; a carbonized proper exciple; a hymenium inspersed with granules or not; hyaline, transversely septate to muriform, amyloid ascospores reacting blue or blue-violet in iodine; and the presence or absence of lichen compounds. There are more than 70 *Graphis* species in China (Jia & Wei 2008, 2009, 2011; Jia 2011, Jia et al. 2012), of which 18 taxa have been reported previously in Hong Kong (Thrower 1988, Wei 1991, Aptroot & Seaward 1999, Aptroot & Sipman 2001, Seaward & Aptroot 2005).

A revision of *Graphis* from Hong Kong conducted under the frame of the Flora Lichenum Sinicorum resulted in the discovery of 11 new records for Hong Kong, including a new species, *Graphis hongkongensis*, and two new records for China, *G. centrifuga* and *G. hyphosa.*

Materials & methods

Hong Kong, special Administrative Region of the People's Republic of China, is located at the southern coast of China with subtropical climate. Material was collected mainly from Hong Kong in 2011 and is preserved in the Herbarium Mycologicum Academiae Sinicae-Lichenes (HMAS-L). A Motic SMZ-168 dissecting microscope (Scientific Instrument Company, Inc., Campbell, USA) and Zeiss Axioskop 2 plus compound microscopes (Zeiss Scope, Oberkochen, Germany) in part connected to Nikon D50 digital microscope cameras (Nikon, Tokyo, Japan) were used for the morphological and anatomical examinations. Lugol's solution, spot tests, and TLC in solvent system C (toluene : acetic acid = 200 : 30) were used for chemical study (Culberson & Kristensson 1970, Culberson 1972, White & James 1985).

Taxonomy

Graphis assimilis Nyl., Bull. Soc. Linn. Normandie, sér. 2, 2: 109. 1868.

Thallus, off-white. Ascomata, sinuous, immersed to erumpent, simple to branched, sometimes clustered (*lineola*-morph); labia, entire proper exciple, completely carbonized; hymenium, not inspersed; ascospores 8/ascus, transversely 8–10-locular, hyaline, 35–50 × 7.5–8.75 µm, I+ blue.

Chemistry: Norstictic acid detected in TLC.

Distribution & ecology: Eastern palaeotropical (Lücking et al. 2009); new to Hong Kong. This corticolous species was previously known from China (Jia & Wei 2011) and India (Adawadkar & Makhija 2006, 2007).

Specimen examined: **Hong Kong. Lautau Island**, the road from Lautau Peak to Nam Shan, 22°14′N 113°56′E, alt. 384 m, on bark of tree, 15 Dec. 2011,Wei Guo & Jinxiu Tian HK367.

Remarks: This species is anatomically and chemically similar to *Graphis intricata* Fée, which differs in its *deserpens*-or *centrifuga*-morph lirellae and smaller ascospores (15–30 µm long).

Graphis centrifuga Räsänen, Suom. Elain-ja Kasvit. Seuran Van. Tiedon. Pöytäkirjat 3: 186. 1949.

Thallus, yellowish grey. Lirellae, immersed to sessile, in satellite clusters (*centrifuga*-morph); proper exciple, completely carbonized; hymenium, 100–120 µm high, inspersed; ascospores, 8/ascus, transversely 6–8-locular, hyaline, 20–25 × 5–10 µm, I–.

Chemistry: Norstictic acid detected in TLC.

Distribution & ecology: Eastern palaeotropical (Lücking et al. 2009); new to China. *Graphis centrifuga* is a corticolous species known also from Australia (Staiger 2002).

Specimen examined: **HONG KONG, New Territories**, Ma On Shan, Mui Tsz Lam, 22°23′N 114°14′E, alt. 187 m, 14 Dec. 2011, Wei Guo HK358.

Remarks: *Graphis centrifuga* most closely resembles *G. cervinonigra* Zahlbr., which differs in its short lirellae (*coarctata*-morph).

Graphis descissa Müll. Arg., Bull. Herb. Boissier 3: 318. 1895.

Thallus, off-white. Labia entire; lirellae immersed (*subserpentina*-morph); proper exciple completely carbonized; hymenium 100–120 µm high, not inspersed; ascospores 8/ascus, transversely 8–10-locular, (20–)28–37 × 6.25–8 µm, I+ blue.

Chemistry: Stictic acid.

Distribution & ecology: Neotropical and eastern palaeotropical (Lücking et al. 2009); new to Hong Kong. The species is an inconspicuous, corticolous species that also occurs in Australia (Archer 2006).

Specimen examined: **HONG KONG**, **New Territories**, Ma On Shan, Mui Tsz Lam, 22°23′N 114°14′E, alt. 187 m, 14 Dec. 2011, Wei Guo HK356–1.

Remarks: *Graphis descissa* resembles *G. flavovirens* Makhija & Adaw. in its thallus containing stictic acid, but the lirellae in *G. flavovirens* are very long and radially branched (*centrifuga*-morph).

Graphis duplicata Ach., Syn. Meth. Lich.: 81. 1814.

Thallus, whitish grey to grey. Labia striate (*striatula*-morph); proper exciple laterally carbonized; ascospores 8/ascus, transversely 8–9-locular, hyaline, 32.5–42.5 × 5–7.5 µm, I+ blue.

Chemistry: No lichen compounds detected in TLC.

Distribution & ecology: Pantropical (Lücking et al. 2009); new to Hong Kong. *Graphis duplicata* is a widely distributed species, found on tree bark in China (Jia & Wei 2011), India (Adawadkar & Makhija 2007), and South America, Philippines, Indonesia, and Australia (Staiger 2002, Archer 2006).

Specimen examined: **HONG KONG**, **New Territories**, Ma On Shan, Mui Tsz Lam, 22°23′N 114°14′E, alt. 70 m, 14 Dec. 2011, Wei Guo HK349–3.

Remarks: *Graphis duplicata* can be distinguished from *G. tenella* Ach. in having *striatula*-morph lirellae and from *G. striatula* (Ach.) Spreng. in having smaller ascospores.

Graphis hongkongensis Wei Guo & J.S. Hur, **sp. nov.** Plate 1

Fungal Name FN570089

Differs from *Graphis gloriosensis* by its *lineola*-morph lirellae and its smaller ascospores with less trans-septation.

Type– China, Hong Kong, Lautau Island, the road from Lautau Peak to Nam Shan, on bark, 22°14′N 113°56′E, alt. 384 m, 15 Dec. 2011, W. Guo & J.X. Tian HK365 (**Holotype**, HMAS-L 128226).

Etymology– referring to the type locality, Hong Kong.

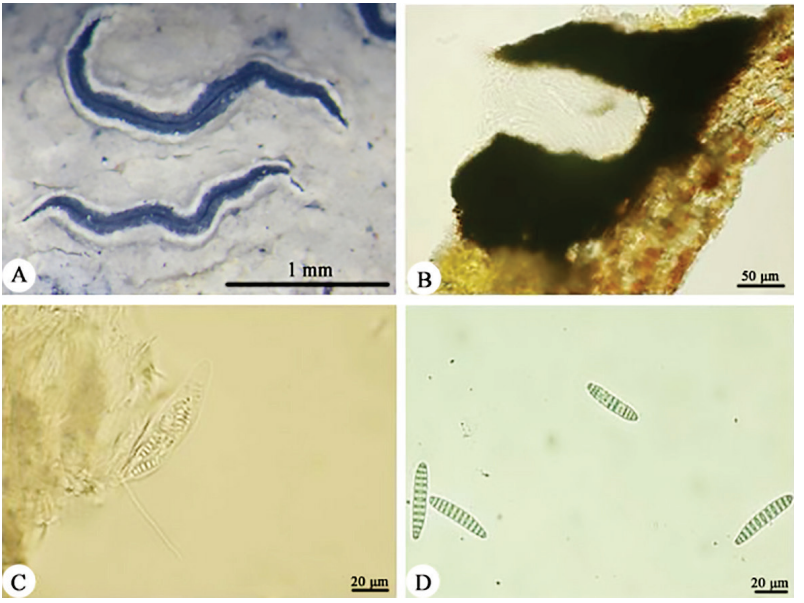

Plate 1. *Graphis hongkongensis* (holotype, HMAS-L 128226). A, habit; B, cross-section of an apothecium; C, ascus with ascospores; D, ascospores.

Thallus pale grayish white to pale white, smooth. Ascomata lirelliform, submersed to erumpent, simple to sparsely branched, 1–4 mm long, 0.2–0.3 mm wide. Disc concealed (narrow to slightly open), blackish brown to black, without pruina. Thalline margin lateral, well developed (*lineola*-morph lirellae). Proper exciple completely carbonized. Hymenium colourless, inspersed, 90–135 µm high, I–. Paraphyses unbranched, dense, thin, 1.25–2.5 µm wide, filiform, warty in tips.

Asci 6–8-spored, 82.5–100 × 17.5–25 µm. Ascospores fusiform, transversely 8–12-locular, 25–50 × 7.5–10 µm, I+ violet-blue.

Chemistry: Stictic acid detected in TLC.

Remarks: *Graphis hongkongensis* closely resembles *G. gloriosensis* A.W. Archer & Elix in having entire labia, a lateral thalline margin, a completely carbonized excipulum, an inspersed hymenium, transversely septate ascospores, and a thallus containing stictic acid. However, *G. gloriosensis* is distinguished by *marginata*-morph lirellae, comparatively larger ascospores (50–90 × 9–16 µm) with more trans-septation, and being so far known only from Australia (Lücking et al. 2009).

Graphis kelungana Zahlbr., which resembles *G. hongkongensis* in having entire labia, an inspersed hymenium, transversely septate and similarly sized ascospores, a thallus containing stictic acid, and a similar geographical

distribution, is clearly separated by its lateral carbonization and *subserpentina*-morph lirellae. *Graphis lineola* Ach., which has similar lirellae morphology and shares most of the anatomical characteristics with *G. hongkongensis*, differs by its laterally carbonized excipulum and a thallus lacking lichen compounds.

Graphis hyphosa Staiger, Bibl. Lichenol. 85: 235. 2002.

Thallus, light yellow to yellowish grey. Ascomata immersed in pseudostromata, stellately branched (*hyphosa*-morph); labia entire; proper exciple completely carbonized; hymenium clear; ascospores 4–8/ascus, transversely 6–9-locular, hyaline, 20–37.5 × 7.5-10 µm, I+ blue.

Chemistry: No lichen compounds detected in TLC.

Distribution & ecology: Neotropical (Lücking et al. 2009). New to China. *Graphis hyphosa* occurs on tree bark in Costa Rica and Brazil (Staiger 2002).

Specimen examined: **HONG KONG, Lautau Island**, the road from Lautau Peak to Nam Shan, 22°14′N 113°56′E, alt. 384 m, 15 Dec. 2011, Wei Guo & Jinxiu Tian HK370.

Remarks: *Graphis intricata*, which also has entire labia, a completely carbonized excipulum, a clear hymenium, and transversely septate ascospores, can easily be distinguished from *G. hyphosa* by its *deserpens*- or *centrifuga*-morph, smaller ascospores, and thallus containing norstictic acid.

Graphis immersella Müll. Arg., Bull. Herb. Boissier 3: 319. 1895.

Thallus off-white. Ascomata lirellae, entire labia, *lineola*-morph; proper exciple, laterally carbonized; hymenium, not inspersed; ascospores 8/ascus, transversely 6–11-locular, hyaline, 20–47.5 × 7.5–12.5 µm, I+ blue.

Chemistry: Stictic acid detected in TLC.

Distribution & ecology: Palaeotropical (Lücking et al. 2009); new to Hong Kong. The species is a corticolous species known from China (Jia & Wei 2011, Zahlbruckner 1930); the Solomon Islands, Christmas Island, and Vanuatu (Archer 2006); Australia (Archer 1999); and India (Adawadkar & Makhija 2007).

Specimen examined: **HONG KONG, New Territories**, Tai Mo Shan, 22°24′N 114°54′E, alt. 906 m, 11 Dec. 2011, Meng Liu HK218.

Remarks: *Graphis immersella* resembles *G. leptogramma* Nyl. in ascomatal anatomy and a thallus producing stictic acid but differs in its slightly smaller ascospores.

Graphis immersicans A.W. Archer, Aust. Syst. Bot. 14: 262. 2001.

Thallus, whitish grey. Ascomata lirellae, erumpent (*lineola*-or *deserpens*-morph); proper exciple, completely carbonized; hymenium 70–90 µm high, not inspersed; ascospores, 4–6/ascus, transversely 6–12-locular, hyaline, 25–45 × 7.5–10 µm, I+ blue.

Chemistry: No lichen compounds detected in TLC.

Distribution & ecology: Pantropical (Lücking et al. 2009); new to Hong Kong. This corticolous species was previously reported from China (Jia & Wei 2011), Australia (Archer 2006), and Philippines (Lücking et al. 2008)

Specimen examined: **HONG KONG**, **New Territories**, Ma On Shan, Mui Tsz Lam, 22°23′N 114°14′E, alt. 187 m, 14 Dec. 2011, Wei Guo HK359.

Remarks: *Graphis immersicans* is close to *G. immersella* in lirellate morphology, but *G. immersella* can be distinguished by its laterally carbonized excipulum and thallus producing stictic acid.

Graphis japonica (Müll. Arg.) A.W. Archer & Lücking, Lichenologist 41: 437. 2009.

Thallus, green to greyish green. Ascomata lirellae, *subserpentina*-morph; proper exciple apically to laterally carbonized; hymenium, 140–160 µm high, not inspersed; ascospores, 4/ascus, muriform, 10–13/2–4-locular, hyaline, 30–67.5 × 12.5–20 µm, I+ blue.

Chemistry: Stictic acid detected.

Distribution & ecology: Eastern palaeotropical (Lücking et al. 2009); new to Hong Kong. *Graphis japonica* predominantly grows on trees and has been previously reported from China (Lamb 1963, Wang-Yang & Lai 1973, Jia & Wei 2011) and Japan (Nakanishi 1966, Nakanishi et al. 2003).

Specimens examined: **HONG KONG**, **New Territories**, Tai Po Kau Country Park, Blue Road, 22°25′N 114°10′E, alt. 136 m, 10 Dec. 2011, Jinxiu Tian HK047, HK052; the road from Nam Chung to Bride Pool, 22°38′N 114°12′E, alt. 41 m, 9 Dec. 2011, Xinli Wei & Meng Liu HK009.

Remarks: This species is most similar to *Graphis streblocarpa* (Bél.) Nyl. in all morpho-anatomical and chemical characteristics, but *G. streblocarpa* has larger ascospores and 1–2-spored asci.

Graphis parallela Müll. Arg., Nuovo Giorn. Bot. Ital. 29: 200. 1892.

Thallus, whitish grey to ivory-white. Ascomata lirellae *opegrapha*-morph; labia entire; proper exciple completely carbonized; hymenium, not inspersed; ascospores 2–4/ascus, transversely 16–23-locular, hyaline, (35–)65–112.5 × (7.5–)10–15 µm, I+ blue.

Chemistry: No lichen compounds detected.

Distribution & ecology: Eastern palaeotropical (Lücking et al. 2009); new to Hong Kong. This corticolous species was previously reported from China (Jia & Wei 2011) and Japan (Nakanishi 1966).

Specimen examined: **HONG KONG**, **New Territories**, Ma On Shan, Mui Tsz Lam, 22°23′N 114°14′E, alt. 184 m, 14 Dec. 2011, Meng Liu HK269.

Remarks: *Graphis parallela* is nearest to *G. bifera* Zahlbr., which differs by its considerably shorter, unbranched sessile, *opegrapha*-morph lirellae.

Graphis plagiocarpa Fée, Essai Crypt. Écorc.: 38. 1825.

Thallus off-white to greyish white. Ascomata lirellae, *dussii*-morph; labia entire; proper exciple completely carbonized; hymenium, not inspersed; ascospores, 2/ascus, muriform, hyaline, (20–)25–28/1–5-locular, 90–150 × (25–) 40–50 µm, I+ blue.

Chemistry: No lichen compounds detected.

Distribution & ecology: Pantropical (Lücking et al. 2009); new to Hong Kong. *G. plagiocarpa* is a corticolous species previously recorded from China (Jia & Wei 2011), Japan (Nakanishi 1966; Yoshimura 1974), Europe (Staiger 2002) and Australia (Archer 2005).

Specimens examined: **HONG KONG**, **New Territories**, Tai Po Kau Country Park, Blue Road, 22°25′N 114°10′E, alt. 157 m, 10 Dec. 2011, Meng Liu HK041–2; Kadoori Garden, Kwun Yam Shan, 22°25′N 114°07′E, alt. 550 m, 12 Dec. 2012, Meng Liu HK242, HK237.

Remarks: *Graphis plagiocarpa* is very similar to *G. lumbschii* (A.W. Archer) A.W. Archer in lirellate morphology but differs in lacking lichen compounds. *Graphis cleistoblephara* Nyl. and *G. sorsogona* Vain. also have short unbranched lirellae (*dussii*-morph), but *G. cleistoblephara* produces norstictic acid, and *G. sorsogona* has a laterally carbonized exciple.

Acknowledgments

This work was supported by a grant from the Korean National Research Resource Center Program (NRF, 2011-0031494). The authors are indebted to Prof. Dr. J. C. Wei, in providing precious suggestions and help in this study. The authors are grateful to Dr. Ze-Feng Jia and Dr. Santosh Joshi for their valuable comments on the manuscript. We express our thanks to senior technician Ms H. Deng for giving assistance in HMAS-L, to Dr. X.L. Wei, Ms J. X. Tian, and Mr. M. Liu in helping specimen collection, and to Dr. H.J. Liu for modification of the graphics.

Literature cited

Adawadkar B, Makhija U. 2006. New species and new records of *Graphis* from India: transseptate species with completely carbonized exciples and norstictic acid. Mycotaxon 96: 51–60.

Adawadkar B, Makhija UA. 2007. New species and new records of *Graphis* from India with partially carbonized exciples and trans-septate ascospores. Mycotaxon 99: 303–326.

Aptroot A, Seaward MRD. 1999. Annotated Checklist of Hong Kong Lichens. Tropical Bryology 17: 57–101. http://dx.doi.org/10.13158/heia.25.2.2010.211

Aptroot A, Sipman HJM. 2001. New Hong Kong lichens, ascomycetes and lichenicolous fungi. Journal of Hattori Botanical Laboratory 91: 317–343.

Archer AW. 1999. The lichen genera *Graphis* and *Graphina* (*Graphidaceae*) in Australia. 1 species based on Australian type specimens. Telopea 8: 273–295.

Archer AW. 2005. New combinations and synonymies in the Australian *Graphidaceae*. Telopea 11: 59–78. http://dx.doi.org/10.7751/telopea20055705

Archer AW. 2006. The lichen family *Graphidaceae* in Australia. Biblioth. Lichenol. 94: 1–191.

Culberson CF. 1972. Improved conditions and new data for the identification of lichen products by a standardized thin-layer chromatographic method. Journal of Chromatography 72: 113–125. http://dx.doi.org/10.1016/0021-9673(72)80013-X

Culberson CF, Kristensson H. 1970. A standardized method for the identification of lichen products. Journal of Chromatography 46: 85–93. http://dx.doi.org/10.1016/S0021-9673(00)83967–9

Jia ZF. 2011. *Graphis paradussii* (*Graphidaceae, Ostropales*), a new lichen species to science. Bryologist 114(2): 12–15. http://dx.doi.org/10.1639/0007-2745-114.2.389

Jia ZF, Wei JC. 2008. *Graphis fujianensis*, a new species of *Graphidaceae* from China. Mycotaxon 104: 107-109.

Jia ZF, Wei JC. 2009. A new isidiate species of *Graphis* (lichenised *Ascomycotina*) from China. Mycotaxon 110: 27–30. http://dx.doi.org/10.5248/110.27

Jia ZF, Wei JC. 2011. Key and checklist for the lichen genus *Graphi*s (*Graphidaceae,* lichenised *Ascomycota*) from China. 122–130, in: HJ Liu et al. (eds). The present status and potentialities of the lichenology in China. Science press, Beijing.

Jia ZF, Wang RF, Wei JC. 2012. Two new species in the *Graphidaceae* (*Ostropales, Ascomycota*) from China. Mycotaxon 121: 75–79. http://dx.doi.org/10.5248/121.75

Lamb IM. 1963. Index Nominum Lichenum inter annos 1932 et 1960 divulgatorum. New York, 809 p.

Lücking R, Chaves JL, Sipman HJM, Umaña L, Aptroot A. 2008. A first assessment of the Ticolichen biodiversity inventory in Costa Rica: The genus *Graphis*, with notes on the genus *Hemithecium* (*Ascomycota: Ostropales: Graphidaceae*). Fieldiana (Botany), New Series 46: 1–131.

Lücking R, Archer AW, Aptroot A. 2009. A world-wide key to the genus *Graphis* (*Ostropales: Graphidaceae*). Lichenologist 41: 363–452. http://dx.doi.org/10.1017/S0024282909008305

Nakanishi M. 1966. Supplementary note of "Taxonomical Studies on the Family *Graphidaceae* of Japan". J. Hiroshima Univ. Series B, Division 2, (Botany) 11: 51–126.

Nakanishi M, Kashiwadani H, Moon KH. 2003. Taxonomical notes on Japanese *Graphidaceae* (Ascomycota), including some new Combinations. Bull. Nat. Sci. Mus. Tokyo 29: 83–90.

Rivas Plata E, Lücking R. 2013. High diversity of *Graphidaceae* (lichenized *Ascomycota. Ostropales*) in Amazonian Perú. Fungal Divers. 58: 13–32. http://dx.doi.org/10.1007/s13225-012-0172-y

Rivas Plata E, Lücking R, Sipman HJM, Mangold A, Kalb K, Lumbsch HT. 2010. A world-wide key to the thelotremoid *Graphidaceae*, excluding the *Ocellularia–Myriotrema–Stegobolus* clade. Lichenologist 42: 139–185. http://dx.doi.org/10.1017/S0024282909990491

Rivas Plata E, Lücking R, Lumbsch HT. 2012. A new classification for the family *Graphidaceae* (*Ascomycota. Lecanoromycetes. Ostropales*). Fungal Divers. 52: 107–121. http://dx.doi.org/10.1007/s13225-011-0135-8

Seaward MRD, Aptroot A. 2005. Hong Kong lichens collected on the United States North Pacific Exploring Expedition, 1853–1856. Bryologist 108: 282–286. http://dx.doi.org/10.1639/0007-2745(2005)108[0282:HKLCOT]2.0.CO;2

Staiger B. 2002. Die Flechtenfamilie *Graphidaceae.* Biblioth. Lichenol. 85: 1–526.

Thrower SL. 1988. Hong Kong lichens. Hong Kong. Urban Council Publication.

Wang-Yang JR, Lai MJ. 1973. A checklist of the lichens of Taiwan. Taiwania 18: 83–104.

Wei JC. 1991. An enumeration of lichens in China. Beijing. International Academic Publishers.

White FJ, James PW. 1985. A new guide to microchemical techniques for the identification of lichen substances. Bull. Br. Lichen Soc., Suppl. 57: 1–41.

Yoshimura I. 1974. Lichen flora of Japan in color. Osaka. Hoikusha Publishing Co. Ltd.

Zahlbruckner A. 1930. Lichenes. Symbolae Sinicae 3. 254 p